

U.S. NAVAL BASE, PEARL HARBOR, DRY DOCK NO. 1
(U.S. Naval Base, Pearl Harbor, Naval Shipyard, Facility No. S779)
On northern shoreline of shipyard, near intersection of Avenue G &
Sixth Street
Pearl Harbor
Honolulu County
Hawaii

HAER HI-65
HI-65

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
PACIFIC GREAT BASIN SUPPORT OFFICE
National Park Service
U.S. Department of the Interior
1111 Jackson Street
Oakland, CA 94607

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HAER HI-65

Location: On northern shoreline of shipyard, west of Dry Dock Nos. 1 & 2, near the intersection of Avenue G and Sixth Street
Pearl Harbor Naval Base
Honolulu County
Hawaii
UTM:
This building falls within the UTM coordinates of the Pearl Harbor Naval Shipyard as defined in the location section of the overview report HABS HI-483. The UTM coordinates for Dry Dock No. 1 are:
04.607600.2361610

Dates of Construction: 1901 (construction began), August 1919 (construction completed)

Engineer: Alfred Noble, Consulting Engineer

Builder: F.B. Smith

Contracting Company: San Francisco Bridge Company

Present Owner: United States Navy

Present Use: Dry Dock

Significance: At the time of completion, Dry Dock No. 1 was one of the largest and most modern dry docks in the world. In addition to its immense size, Dry Dock No. 1 was an important engineering and construction feat, employing a unique construction technique. Moreover, the dedication of the dry dock signified the dedication of the Pearl Harbor Naval Base, since a base without a dry dock was inefficient and unserviceable in time of war. Dry Dock No. 1 was a major focus of the December 7, 1941 attack since 3 ships, including the USS *Pennsylvania*, were docked here. This resource is one of the most historically significant facilities in the Shipyard and is listed as a Category One historic resource in the *2001 Pearl Harbor Integrated Cultural Resource Management Plan (ICRMP)*.

Historian: Lorraine M. Palumbo, Architectural Historian with Mason Architects, Inc.

Project Information: Photo documentation and recordation of this facility by the Navy has been done in response to the ongoing renovation of the structure. Photo documentation of historic facilities by the Navy assists in prepared prior to taking actions. Also, photo documentation assists the Navy in gaining more information about its historic facilities to assist in making proactive management decisions. This project is being supervised by Jeffrey Dodge, A.I.A. Historic Preservation Specialist at the Pacific Division, Naval Facilities Engineering Command (NAVFAC EFD Pacific). The photographic documentation was undertaken by David Franzen, photographer. Lorraine M. Palumbo, Architectural Historian, of Mason Architects, Inc. prepared the written documentation. The field work and research was conducted for this report between January 2002 and August 2002. It was edited in 2009 by Anne Mason, HAER Collections Manager, to better comply with HAER standards

This report provides a contextual overview for all the dry docks at U.S. Naval Base, Pearl Harbor listed in the chart below. HAER surveys for the Dry Docks Nos. 2 through 4 have been prepared and can be reviewed for additional information about the individual structures:

HAER Number	Facility Number	Report Name	Date
HAER HI-66	S780	Dry Dock No. 2	1940
HAER HI-67	S781	Dry Dock No. 3	1941
HAER HI-15	S782	Dry Dock No. 4	1943

Description:

General Description of Dry Docks

A dry dock is a device used for exposing the entire hull of the vessel for purposes of cleaning and repair. There are two main types of dry docks: floating and graving. The Bureau of Yards and Docks' emphasis in the early decades of the twentieth century was to build graving dry docks, since these docks are more permanent, requiring less maintenance. The U.S. Department of the Navy, Bureau of Yards and Docks published a book entitled *Activities of the Bureau of Yards and Docks, World War 1917-1918*, in 1921, which described the significant developments and objectives that the Navy had during this intense period of growth. The chapter entitled "Dry Docks" proudly describes the dry dock construction developments made during those years and provides a description of the dry docks being built at the time:

A graving dock is essentially a basin, lined usually with masonry, excavated to accommodate hulls of given dimensions, plus adequate working space. This basin has access to deep water through a gateway, usually a floating caisson conforming exactly, along its longitudinal profile, to the opening. A ship, having been floated into the dock, the caisson is put in position and the dock basin is emptied by pumps installed as part of the equipment, and the ship gradually settles in conformity with her particular lines. With the vessel. The docking operation is a frequent necessity in the efficient life of any ship, particularly of a naval vessel.

The construction of a graving dock is no small undertaking, and calls for exact design and close supervision by the bureau. The difficulties to be overcome are often prodigious, in spite of painstaking preliminary plans and investigations. The elements of a dry dock problem may be summarized under the following subdivisions: 1) the body of the dock, its excavation and lining; 2) the pump well and its equipment; 3) the caisson and its seat; 4) the crane and its runway encircling the dock outside the coping; 5) the mooring devices and power-driven capstans for handling vessels into position; 6) the docking blocks, of specially selected timber, involving many thousands of board feet of material of great strength, and great care in workmanship; all the foregoing constitute engineering operations of respectable magnitude. At every stage of construction, multitudinous details emerge for attention. It may be said, paradoxically speaking, that it is the unexpected which may be expected at all times during the construction of a dry dock.¹

Construction Process of Pearl Harbor Dry Dock No. 1

The construction of the dry dock began in 1909, with the first attempt destroyed by hydrostatic pressure in 1913. The details of this first attempt are covered in the Historical Context section of this report, see page 6.

The Pearl Harbor Dry Dock No. 1 measures 1,001' from the head to the side of the caisson, with a width of 114' at the bottom and 138' at the top, and a depth of 32'-6" from the mean high water to the keel blocks.

The construction method of this dock is the most significant and noteworthy aspect of the dock. The challenge was to lay the floor of the dock and hold it down against the full hydrostatic pressure of the water. It would have been impractical to have made the floor so thick that it would have stayed down by its own weight, and this was not necessary because the side walls resting on the floor would serve as weights to hold it down, provided the construction of the floor was such as to prevent it from being burst open in the middle. In other words, the floor had to withstand pressures, which were the reverse of those encountered in the floor of an ordinary structure. This called for the use of exceedingly substantial trusses, capable of enduring the tremendous hydrostatic pressure, across the entire span of the dock. The new plan was to build the floor sections on a floating dry dock, and then to use a structure known as a "cofferdam-boat" to pick the floor section off the floating dry dock, after which it could be towed and lowered to its final position, cofferdam and all, and while in this position, the side walls of the section would be built within the walls of the cofferdam.²

The design consisted of dividing the 1,000-foot length into 16 sections and constructing the shell of each section base on a floating dry dock. The shell section measured 152' long (corresponding to the width out-to-out of the finished dock floor), 60' wide (16 sections divided in 1,000') and 16' high, with the floor of the shell about 8' thick and sides of varying thicknesses. Between each

¹ U.S. Department of the Navy, Bureau of Yards and Docks, 1921: 237-238)

² Scientific American, 1919: 202

pair of sections was a gap of three feet at the top and five feet at the bottom of the floor, and this gap was filled in with concrete by means of tremies.³ The tremie process is utilized for underwater construction and involves dropping concrete through a tremie; a pipe or tube with a funnel shaped (hopper) piece at the top. The hopper piece acts as a receptacle to deliver the concrete.

A floating dry dock was first built with a clear space of 76' between the side walls and on this the floor sections of the concrete dock were constructed. There were seven steel trusses in each section, approximately 150' long and spaced 10' apart. The steel trusses were then filled in with concrete, but in order to reduce the weight as much as possible and facilitate handling of the heavy slab, the middle pockets of the floor section were only partially filled. This shell of concrete, together with its embedded steel trusses, weighed about 7,000 tons, with a displacement of about 4,000 tons.⁴

The floating dry dock on which each section base was constructed had a lifting capacity of about 3,500 tons. After a floor section had been prepared the floating dry dock was lowered to permit the towing of the cofferdam-boat over the floor section. This cofferdam-boat consisted of a huge steel box and was deep enough to reach above water level when the floor section was sunk to its final position. The cofferdam-boat was sub-divided by means of bulkheads to form water ballast tanks, which would be filled with water to lower the structure with the floor, which it was carrying. At each end of the cofferdam there was formed a compartment which was open at the bottom and within which the side walls were to be built. After the tank had been floated over the floor section, the floating dock was first raised to permit the attachment of the cofferdam-boat to the floor and then it was lowered, to permit the removal of the cofferdam-boat with its floor.⁵

After each section shell was constructed, the cofferdam-boat or steel ballast tank was then bolted to the upper chord truss and brace channels along the outer perimeter of the concrete section. Canvas and rubber hose was used for packing to secure a water-tight joint. When this steel ballast tank was pumped out, the concrete base attached to the bottom of the tank was lifted and the whole towed to its location in the dock. Then, by adding water to interior compartments of the ballast tank, the section was sunk on a prepared foundation of piles covered with one foot of broken stone. This steel ballast tank was designed such that, when pumped out, it formed a steel cofferdam with interior water ballast compartments. This permitted the remaining concrete in the floor and side walls of each section to be deposited in their final location "in the dry." Following this, the bolts connecting the cofferdam-boat and the concrete section were backed out, so that the boat rose and floated free. Curtain steel doors were then removed from the inshore side to clear the tops of the concrete section side walls, and the tank was towed back to be deposited in position. This the work proceeded step by step.⁶

This method applied to all sections except the first section, or the head, where, because of the side walls being on a curve, they could not be constructed inside the steel cofferdam. At the head of the dry dock, the semi-circular wall was formed of pre-cast blocks, each weighing about 145

³ U.S. Department of the Navy, Bureau of Yards and Docks, 1921: 251. Tremie is an apparatus for depositing and consolidating concrete under water, <http://www.wordwebonline.com/en/TREMIE>, accessed 21 May 2009.

⁴ Scientific American, 1919: 202

⁵ U.S. Department of the Navy, Bureau of Yards and Docks, 1921:251

⁶ Scientific American, 1919: 203

tons, which were lowered upon the floor section that had been set in place by means of a stationary 150-ton floating derrick (YD-25). Keyways were provided for making the wall blocks fast to the floor by way of tremies. After the floor sections had been laid, the spaces between them were filled with concrete by means of tremies and the spaces between the wall sections were filled in by workmen operating within local cofferdams.⁷

The first section of floating dry dock pontoon was launched on June 22, 1915. The steel ballast tank was launched February 12, 1916. Steel erection of section 1 of the dry dock was started in the floating dock during the last week of April and on July 7, 1916, this first section of the dock was lifted free from the floating dock and sunk into its final location the following day. On September 8, 1916, the second section was landed. On January 25, 1917 the fifth section, on July 14-17, the tenth section, and on January 3, 1918, the fifteenth section was landed.

After the fifteenth section was placed, the public works officer was detached and ordered to the Bureau of Yards and Docks as chief with rank of rear admiral, and the public works officer at Great Lakes, Commander Geo. A. McKay (C.E.C.), U.S.N., was detached on January 26, 1918 and ordered to Pearl Harbor to continue the work. The construction at the time was about 80 percent complete. Then the sixteenth section was sunk, and concreted. It was necessary also to set the outer granite sill for the caisson gate before the tank could be released. This interfered in part with some of the interior steel bracing, which was cut away by acetylene torch as necessary. All of the work was performed "in the dry" inside the steel cofferdam or ballast tank, at the depth of about 40' below water.

After the sections were set, there remained the work of concreting joints between the bases and side walls before the dock could be unwatered. This was accomplished by means of a tremie plug of concrete to seal the bottom of the joints; the concrete was approximately 6' to 8' thick. The joints of the side walls between sections and between the head blocks at the curve of the dock were then covered with wooden cofferdam shutters, rubber hose being used for gaskets, the joints pumped down, and concrete deposited "in the dry" to above mean low water.

To keep the stresses in the dock within safe limits and to provide a factor against flotation, the earth all around the side walls was back filled before unwatering. Piles of rock ballast were also placed in the center of each section of an amount sufficient to offset the stresses from reduced weight due to the not-yet-built last 18 inches of the concrete floor.

The steel cofferdam ballast tank could not be used in the construction of the pump well, which was 96' long and 45' in plan, and designed to rest on piles 5'-6" below low water. The pump well floor was 3' thick, while the walls varied from 5'-6" thick as base to 3'-0" at top. There were five interior compartments for pumps. The lower 17' portion of the pump well (floor and walls) was constructed on the floating dry dock. On this concrete base a wooden cofferdam, measuring approximately 102' x 51' x 40' was built of 6" x 12" timbers. The floating dry dock was then submerged and the pump well concrete base was floated out and moored over the final site. It was then sunk and set into place.⁸

⁷ Scientific American, 1919: 203

⁸ U.S. Department of the Navy, Bureau of Yards and Docks, 1921: 248

The caisson was seated on March 25, 1919, and pumping of the dock started on March 31. Unwatering was completed on April 10, 1919. With the removal of water load, the dock rose as a monolith 3/16 of an inch. Following this, the interior dry dock floor joints were completed; the upper 18 inches of concrete floor with imbedded cast-iron chains were laid; stairs, rails, keel blocks, etc., were finished; small leaks were closed; and the dock was completed.⁹

Basic Structural Data of Dry Docks No. 1, No. 2, No. 3, and No. 4

The following table provides the basic dimension and capacities of the four dry docks of the Pearl Harbor Naval Shipyard. It allows for an at-a-glance comparison of the scale of the dry docks. Interestingly, although Dry Dock No. 1 was built more than 20 years before the other dry docks, its vital statistics are as impressive as those built a generation later. This information has been copied from the table, which is part of the unpublished files entitled *Dry Dock Data*.¹⁰

DRY DOCK DATA					
		No. 1	No. 2	No. 3	No. 4
	Year Built	1919	1942	1942	1943
1	Maximum docking capacity, overall length of dock	1,001'-10"	975'-5-7/8"	497'-8-5/8"	1,099'-2-1/4"
	Maximum docking capacity, width at opening at high water level	123'-0"	144'-3-3/4"	96'0"	153'-2-1/2"
2	Height of sill above floor	2'-0"	2'-0"	2'-0"	2'-0"
3	Depth of water above keel blocks, at mean low water	31'-0"	43'-0"	18'-6"	43'-0"
	Depth of water above keel blocks, at mean high water	32'-6"	44'-6"	20'-0"	44'-6"
4	Keel blocks above sill of dock	2'-6"	2'-0"	2'-6"	2'-0"
5	Keel blocks above floor of dock	4'-6"	4'-0"	4'-6"	4'-0"
6	Depth of water above sill of dock, at mean low water	33'-6"	45'-0"	21'-0"	45'-0"
	Depth of water above sill of dock, at mean high water	35'-0"	46'-6"	22'-6"	46'-6"
7	Minimum draft of caisson	25'-6-1/2"	28'-0"	16'-6"	32'-0"
8	Desirable clearance between bottom of caisson and sill of dock to remove caisson	3'-0"	3'-0"	1'-6"	3'-0"
9	Time required to flood empty dock and remove caisson	1 hr - 10 min.	1 hr. - 20 min.	23 min.	1 hr. - 25 min
10	Time required to pump and remove caisson	20 min.	20 min.	30 min.	20 min.
11	Time require to pump dock dry (dock empty) with all pumps operating	2 hrs. - 30 min.	1 hr. - 55 min.	27 min.	3 hrs. - 5 min.
12	Total capacity of dry dock pumps	340,000 gal./min.	360,000 gal./min.	260,000 gal./min.	89,325 gal./min.

⁹ U.S. Department of the Navy, Bureau of Yards and Docks, 1921: 251

¹⁰ Pearl Harbor Naval Shipyard, n.d.

Historical Context:

Development of U.S. Navy Dry Docks during World War I

World War I started in Europe in 1914. By the time the United States declared war in 1917, the Government was already committed to a policy of military facility expansion. When the question of the United States becoming a party to the war arose, and careful attention was given to American facilities available for both offensive and defensive warfare, one of the most important defects found was the lack of proper dry docks, both for capital ships of the Navy and for ships that would have to be taken over for transports.¹¹

The U.S. Navy's docking inventory in 1916 consisted of 21 dry docks of all sizes and types, with the Balboa dock of the Panama Canal just completed. The Balboa dock was the first example of the 1,000 foot class to be found in the Western Hemisphere. It was available for naval use, but remotely located in relation to the U.S. coasts. Aside from this dock, the Navy could boast only one dock better than 800' in length, and two 740' long, the remaining 18 ranging below the latter figure down to 324', in the case of one dock built in 1834.¹²

Congress recognized the country's deficiency in the matter of docking facilities, and passed appropriations that made possible the construction, acquisition, or preferential use by the Navy of five modern dry docks. The proportions and equipment of these five were excelled only in one or two instances in the entire world. Four of the five were completed in 1919 or 1920, and were finished and added to the Navy's inventory in 1920, so that the Navy had a total of 27 permanent graving docks and two floating docks. Six of the permanent docks were capable of receiving the largest war or merchant vessels existing.¹³

Establishment of the Navy Yard at Pearl Harbor

The 1887 extension of the reciprocity treaty, relating to the importation of Hawaiian sugar duty-free, had granted the United States sole rights to Pearl Harbor for these uses. However, Congress did not provide any funding to deepen the water at the mouth, and so no use was made of Pearl Harbor by the U.S., until after Hawaii was annexed. Congress appropriated the first funds for development of the Pearl Harbor base in March 1901. For the harbor and ship repair facilities to be usable, the channel from the entrance required extensive dredging.¹⁴

The 1901 dredging contract required only the removal of sand, which left coral heads jutting into the channel, rendering it hazardous to all but small vessels. In 1908, a more extensive dredging contract was signed. Hawaiian Dredging completed the 35-foot deep and 500- to 600- foot wide channel, and in 1911 the first large ship, the USS *California*, was able to enter Pearl Harbor. Now ships could come into the harbor for repair, but repair shops were still under construction.¹⁵

¹¹ U.S. Department of the Navy, Bureau of Yards and Docks, 1921

¹² U.S. Department of the Navy, Bureau of Yards and Docks, 1921

¹³ U.S. Department of the Navy, Bureau of Yards and Docks, 1921

¹⁴ Yoklavich, 2000: 4-5

¹⁵ Yoklavich, 2000: 4-5

First Construction Attempt of Dry Dock No. 1

Congress allocated moneys for the development of the Yard with the Appropriation Act of May 13, 1908. This included \$2 million for a dry dock, an essential facility for a repair base. Because this was such a critical facility for the Navy Yard, the desire was to get the biggest possible dry dock for the money. The hope was to get a dry dock big enough to handle the Navy's largest ships, existing and planned. Designs for the dry dock changed as dimensions, available funds, and contractor's prices were juggled. In 1909, the initial contract was awarded to Pacific Bridge Company. The price for the dry dock totaled over \$3 million by 1913.¹⁶

When the dry dock was originally planned, the wash boring at the site of the dock seemed to indicate that the underlying strata were suitable to permit the construction of the dock in the usual open cofferdam method. The excavation was made with dredges to a depth of 35 to 38', and the material was loosened by blasting in advance of the dredge. It was assumed that the bottom was impervious to water, and that there would not be any excessive hydrostatic pressure on the underside of the dock. Accordingly, a large cofferdam was built by driving a wall of sheet piling into the bed and bracing these side walls with a system of timber trusses.

However, in February of 1913, the partially completed facility was destroyed by hydrostatic pressure, which burst the concrete bottom, and collapsed side sections. The events leading up to the eventual demise of the partially completed dock are outlined here. After one section of the cofferdam was completed the pumps were started and the operation of unwatering it was begun. The pumps were kept at work for eleven days, the water level gradually lowered, but despite repeated efforts, it was impossible to lower the water more than 21'. The cofferdam began to show signs of distress as the work proceeded. At 10 am, February 17, the sheet piling began to rise at an alarming rate from the tremendous hydrostatic pressure below and the pumps were stopped at 2 pm, at which time measures were taken to seal the bottom. It was proposed that a flooring of concrete be placed underwater by means of tremies to a depth of 6 to 8 feet. In order to hold this concrete in place, piles had been driven into the bottom with their head projecting so that when the concrete was poured in they would form an integral part of the floor. This done, the work of unwatering the cofferdam started in Section No. 2, and when it had been unwatered to a depth of nearly 37', exposing some of the concrete, it was observed that the cofferdam was beginning to rise again.

The distress developed rapidly and before further movement of the cofferdam could be checked, the entire section collapsed. The engineers, the naval officers, and the workman could only stand aside and helplessly watch the fruits of four years of labor and millions of dollars crushed into a shapeless mass of debris. At 3 pm, all sections of the cofferdam collapsed, the cribbing lifting several feet at the instant of failure. The hydrostatic pressure burst the concrete bottom, throwing it up and lifting the piles out of bed. When Section 2 collapsed, the sections to either side of it also gave way, and "the work, which represented more than two years of labor was in the twinkling of an eye turned into a pile of junk."¹⁷

¹⁶ Yoklavich, 2000: 4-5

¹⁷ Scientific American, 1919: 202 and Thrum's Hawaiian Annual, 1919: 39-40

Luckily, workers were able to get out before the dry dock exploded, but four years of construction lay in ruins. Moreover, all of the laborers were laid off, some 1,000 men in total. The Navy's annual report noted this event as "the Naval disaster of the year," and the Hawaiians felt the shark goddess Ka'ahupahau and her son Kupipi had been angered by the construction.¹⁸

Renewed Efforts of the Construction of Dry Dock No. 1

The first important task given to Secretary Daniels when he stepped into position as Secretary of the Navy on March 5, 1913, was whether to proceed with the construction of the Dry Dock at Pearl Harbor or whether to cease construction altogether. There were able men who said that the island of Oahu, being made of volcanic and coral formations, did not have the structural strength to support the foundation of a graving dock.

These analyses were based upon the geological conditions, which were studied by taking a series of core borings that revealed a peculiar formation of strata. The earth's composition at Pearl Harbor was built up from below by coral polyps and from above by volcanic deposits. There was a confused mixture of coral and volcanic stone, which had been broken up and thoroughly mixed by the ocean waves. In some places, the material was so hard that it resisted pile driving. In other places, it was exceedingly soft. There was a layer of clay-like mud, varying from 4-40' deep. While this was to a certain extent impervious to water apparently the construction work had disturbed it to such an extent that water could pass through it with sufficient freedom to give the full hydrostatic pressure on the bottom of the dry dock.¹⁹

Eminent geologists and engineers were called in to consult in conferences extending over weeks and months. Questions of whether volcanic and coral formations could accept a large graving dock were asked. Analysis of the proposal that a floating dry dock would be the only safe alternative was discussed. There were differing opinions from the advisors. In the end, the need of a graving dry dock was found imperative. Also, the maintenance expenses of a floating dock, along with its limitations, drove the decision that, if at all possible, a large permanent dry dock should be constructed. Of course, this having been concluded, while the task of designing the new dry dock proceeded, the easy solution of building a floating dry dock surfaced daily.

In addition to studying the reports of geologists and consulting them, a number of the ablest civil engineers in the Navy were summoned to Washington and asked to make plans for consideration. The services of the distinguished engineer Alfred Noble, the President of the American Society of Civil Engineers were retained as Consulting Engineer. His reputation and accomplishments gave assurance that the Navy would have the best expert advice. In August of that year, he visited the site of the dry dock at Pearl Harbor for a personal examination of the conditions of the site. This was supplemental to his study of the voluminous records and data that had been furnished to him.

In October after numerous conferences attended by the Chief of Material and Civil Engineer, Admiral Winterhalter, Chief of the Bureau of Yards and Docks, H.R. Stanford, and with the

¹⁸ *Pearl Harbor Log*, 1953: 5

¹⁹ *Scientific American*, 1919: 202

assistance of F.R. Harris, L.M. Cox, and E.R. Gayler, the comprehensive report and recommendation of Mr. Noble was received. His proposed design for the dock and its method of construction was a marked departure in engineering work. Mr. Noble's death did not allow him to see the completion of the final draft. However, the design embodies all the elements of strength and safety recommended in his report. On November 19, 1914, the Navy signed the supplemental agreement, which allowed for the completion of the dock.²⁰

Hawaiian Offerings Made Before the First Pour of Concrete

Actual work resumed in the spring of 1914 only 13 months after the collapse of the first attempt, and before the supplemental agreement was signed. The cleaning and preparation of the area involved a significant amount of work. An eight-foot-thick layer of concrete and thousands of piles had to be removed. Moreover, the whole area was dredged another six feet deeper than it was originally. After the bottom was dredged, piles had to be driven again covering an area of 180' x 1,000', spaced exactly five feet on center. They were sawed off to an even 48' height at low tide. The whole area was filled with clean blue rocks (dense volcanic stone). Four layers, in total, were placed, starting at about 52' below water level up to the level of the piles.²¹

After the area was prepared and the first pour of concrete was about to commence, Walter Dillingham, President of Hawaiian Dredging Company, came to the site to ask specifically about getting someone to bless the area before work commenced. This had not been done previously, and many felt that the shark goddess Ka'ahupahau and her son Kupipi, who is said to have been living in the immediate vicinity of the construction of the dry dock, had caused the failure of the first attempt. A short excerpt of the story told by David K. Richards, a Hawaiian foreman who worked from beginning to end on Dry Dock No. 1, is quoted below. This excerpt is a conversation between the Hawaiian *kahuna* (priestess) and Richards, discussing the christening of the dry dock:

Upon arrival home I met the old lady, and I kissed her. Then she asked what did I want her for [sic] I told her that I wanted her to christen our dry dock in the Hawaiian custom. She said it was all right; and then she pulled out her little Bible and said that "our first custom is to ask God, through the Bible, if he allows me to undertake the job of christening the drydock." So she prayed, and I also prayed. Then she opened the Bible and read from a verse, asking whether she is allowed to perform the ceremony. The next question which came up was the location of the dry dock. She prayed again, after which she opened the Bible and read it and then said, Oh, that location is a sacred place; it belongs to shark God and Kaahupahua. Did not you people had [sic] trouble working there?" I answered in the affirmative, and added that the first dock blew up. "Was anyone killed?" she asked. I said, "No, just missed by a few seconds." I said that, according to the Book that if the company want [sic] to build anything big you must make some offerings and must be made right, and if not the company will suffer

²⁰ Thrum's Hawaiian Annual, 1919: 40-41

²¹ Richards, 1941: 4

in life and money. She continued, "It's lucky that nobody is killed." She said, furthermore, "Don't fail to make offerings!"²²

During the construction of the dry dock there was much opposition to the *kahuna* and the Hawaiian offerings. However, there were many events which indicated that care should be taken to appease the Hawaiian gods. Finally, at the end of construction, the backbone of a large shark was found. In his story, Richards explains:

As we went along pumping water out of the dock, we pumped out five feet and cleaned the side and plastered and corked all the leak [sic], 15 to 20 days and then pumped till we got to the bottom which was full of mud and in the middle of the dock where I went through a cave of nine feet diameter, Mr. Hartman, assistant boss, found a backbone of a big shark, 14'-4" long. I came by where they were working when Mr. Hartman said to me, "You certainly got the shark. Here it is. I take off my hat to you, Dave!" He was one of the worst men in bawling me out for having the *kahuna* there, and I was due to be sent to Kaneohe soon. My whole family, including my wife and many others, felt that way towards me. The day after I dedicated, the old woman came down to the dock with crackers. She went to the water and said, "No more *pilikia* [trouble] to this dry dock. The next time when big job is to be undertaken, do call me to clear the *pilikia* before you start to build."²³

Richards concludes his account with an apology, saying "Walter [Dillingham] and I should be punished because we failed to continue [to make offerings up] to the finishing of the main buildings in Pearl Harbor with Hookupu, or offering." However, the dry dock construction was completed successfully in the summer of 1919 and its completion was celebrated in grand style on August 21, 1919. Final construction cost for the facility was \$5,064,500, in all its stages, from 1909 to the date of completion.

Opening Day Ceremony

The long-awaited opening day was marked with an impressive ceremony. The formal opening of the dry dock, on August 21, 1919, was attended by the Secretary of the Navy and about 7,000 others.²⁴ The Governor of Hawaii declared it a special holiday. Instead of docking a ship in a full dock, which would have required a two-hour pumping period before the bottom was exposed; it was decided to have the dock empty so that it might be viewed, and to admit water through all sluiceways. After appropriate ceremonies, Mrs. Daniels pressed a button, which opened the three large sluice gates, making a spectacular sight.

The dry dock's construction had been a ten-year contest with natural and other unforeseen obstacles. The original contract made in 1909 called for a dry dock 589' long. That seemed to be an ample size for the docking of the Navy's largest ships of that period. In 1909 none could dream of the immediate need for a dock larger the 589'. But within a brief period, the need of

²² Richards, 1941: 4

²³ Richards, 1941

²⁴ Yoklavich, 2000:4-5

larger ships led to the construction of ships of the *New York* and *Texas* class, a class calling for a dock of about 800' in length. The Pearl Harbor contractors were directed to increase the length of the dry dock by two hundred feet. That was the vision of that day when nobody imagined constructors would see beyond the limits of the Panama Canal. Later, ship sizes grew from 800' to 1,000' long. Thus, when the contract was revised, the larger view of naval construction called for a dry dock 1,001' long and 138' wide. The Pearl Harbor Dry Dock was one of the largest in the world and was one of the most modern, meeting all of the present-day needs. It could dock the largest dreadnaughts (battleships) afloat and the largest under construction at the time.²⁵

Thurms Hawaiian Annual of 1920 best recalls the day of the opening ceremony of Dry Dock No. 1:

August 21, 1919, witnessed the triumph of engineering skill over unprecedented obstacles attending the construction of America's great naval dry dock, at Pearl Harbor, and its successful opening with appropriate dedicatory exercises befitting the occasion. For this notable event Secretary of the Navy Joseph Daniels and party made the special journey from Washington to these shores to participate therein, arriving here on the dreadnaught *New York*, August 20th.

In recognition of the importance of the event, the 21st had been proclaimed a public holiday. And the day proved auspicious, vast crowds of all nationalities, by train and by auto and other vehicle, and afoot, thronged the naval station to witness the interesting world-event, "the dawn of a better day." Secretary and Mrs. Daniels, participating officials and distinguished guests, occupied a canopied structure at the head of the dock. And bleachers lining both sides of the dock served the invited throng.

Throughout the ceremony there were men watching and participating in the great national event who were dominant in the work. They were Secretary of the Navy Daniels, who said he had "sweat and blood all one summer," following the collapse of 1913; President S.G. Hinde, of the contracting company, who, in delivering the dock to the navy chief, said the work had been done "honestly and conscientiously" and that it was the "best dock ever built;" there was F.B. (Drydock) Smith, the man who built it, whose engineering skill and tenacity made the dedication possible; W.F. Dillingham, president of the Hawaiian Dredging Company, who stood by the enterprise and carried the project through; Rear Admiral C.W. Parks, U.S.N., chief of the bureau of yards and docks; Rear Admiral Fletcher, U.S.N. Commandant, whose station organization was so effective during the final months of the completion of the work; Commander W.N. McKay, who tied up the finishing threads and knotted them well.

The address of the occasion covered well the history of the dock's construction, the futility of the first effort, and the present status of this new and vaster undertaking, with inspiring prophetic utterances for the future in its dedication to "the God of

²⁵ Thurms's Hawaiian Annual, 1919

Civilization, the God of Commerce, and the God Christianity." The Annual is indebted to the *Advertiser* of August 22d. for the following excerpts:

Rear Admiral W.B. Fletcher, U.S.N., opened the ceremonies, when he arose and faced the Secretary and addressed him, saying: We are here this morning to dedicate this dock and testify by our presence our appreciation of the foresight, wisdom, and skill of those who are responsible for the inception and construction of this splendid work, and we admire the fruits of their labor. This dock is the sanitarium, and the hospital of the ship. In it, ships will renew their vigor and not only the ship of war, but all ships whatever their character. It takes no great stretch of the imagination to see that its usefulness will multiply as time goes by and because of the position of these islands in the center of the vast expanse of the Pacific that sisters to it will be necessary as the world continues to grow.

Upon these comments, Rear Admiral W. B. Fletcher proceeded to thank specific individuals including S.H. Hinde, president of the San Francisco Bridge Company, the contracting company for the dock, F.B. (Drydock) Smith, the builder of the dock, and the Hawaiians who participated in the construction, particularly the Hawaiian divers.

Secretary of the Navy, Joseph Daniels' address followed:

Today we open and dedicate this big drydock and thereby gain for ourselves and Pacific commerce the large use of Pearl Harbor, ceded to the United States by the Hawaiian Government by the convention of 1887. The importance of that concession, adopted as it was then for naval purposes and essential as it is now for the Navy and for commerce, was little realized during the years that followed.

So indifferent were men to the potential worth of Pearl Harbor that no action was taken for its use and the American flag was not even raised over the landlocked harbor for many years after the grant was confirmed. But, with the simultaneous completion of the drydock and the coming of the powerful Pacific fleet to this mighty ocean, you Americans residing in Hawaii and we Americans residing on the continent have a comradeship in appreciation of what Pearl Harbor means. The completion of this drydock and the coming of great ships cements our national unity.

The war taught us many lessons. Perhaps the most important was the error of the ancients that oceans and seas were created to separate peoples dwelling apart on distant island and continents. This world war has enforced the truth that the waters of the great deep were made to unite and not to keep men and nations separate. By common ties of country and a common destiny the dweller on Honolulu and the dweller in Washington are as united as the residents of the cities of a single American state. The coming of the *New York* and the destroyers today is the forerunner of the coming of the whole Pacific fleet which in all coming years will be as much at home as in the harbor of New York or San Francisco or any other harbor in our giant Republic.

Upon the completion of Secretary Daniels' speech, Mrs. Daniels pressed the button that would enable the dock to raise an American flag in celebration of the great accomplishment.

Losses Sustained During the Attack on Pearl Harbor and its Role during WWII

A memorandum from the Public Works Officer to the Commandant describes the damages sustained on Dry Dock No. 1. It states:

One bomb struck the east side of the dock 330' from the inboard end, shattered about 40 lineal feet of the upper portion of the dock wall to a depth of about six feet and blew out approximately 120 square feet of the dry dock crane track section. One electric manhole, four electric and two telephone cables were destroyed. Repairs were immediately undertaken and will be completed in 10 days at an estimates cost of \$20,000. It has not been possible to determine other possible damage to the dock such as blocking caused by fire in USS *Cassin* and the USS *Downes*, which were in this dock with the USS *Pennsylvania*.²⁶

At the time of the attack, the battleship USS *West Virginia* was moored outboard of the USS *Tennessee*, at berth F-6 along Ford Island. She took six torpedoes and two large bombs. The ship was sunk and rested on the bottom. Large cofferdam patches were set and the ends were sealed by concreting under water. All of the ammunition, most of the oil, and a large part of the stores and provision were removed, and the ship was floated on May 17, 1942. It was brought to Dry Dock No. 1 on June 9, 1942 where it received temporary repairs.²⁷ After her temporary repairs, she rejoined the fleet on July 4, 1944, won five battle stars, and sailed into Tokyo Bay for the Japanese Surrender in 1945.²⁸ Many other ships were repaired in the dry dock during World War II.

Later Improvements to Dry Dock No. 1

Since initial construction, the caisson has been overhauled and repaired several times. In 1969, electrical power improvements for the dry dock were made. In 1976, floodlights were installed in the dry dock. In 1977, repairs were made to the concrete walls. In 1979, under MILCON Project P-097, "Drydock No. 1 Improvements," work commenced to replace the old caisson, modify the caisson seat, and waterproof the utility galleries.²⁹

²⁶ U.S. Navy Yard, Pearl Harbor, T.H. 1941

²⁷ Pacific Bridge Company, 1944: 94

²⁸ Lott and Sumrall, 1977: 24

²⁹ Pearl Harbor Naval Shipyard, 1980

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